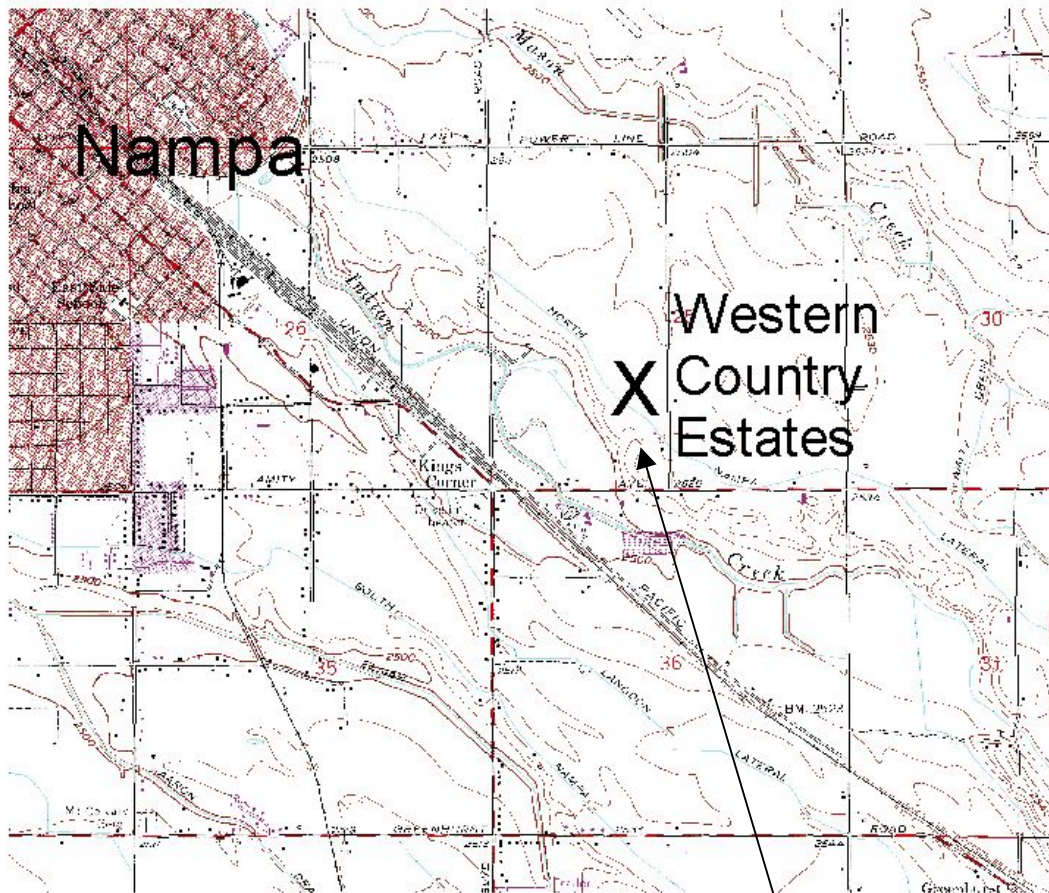




# Idaho Department of Environmental Quality Boise Regional Office



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## **Abstract**

The Southwest District Health Department requested a ground water study be conducted by the Idaho Department of Environmental Quality (IDEQ) after finding several elevated nitrate results in domestic wells in the Western Country Estates subdivision in Nampa, Idaho. This ground water study assessed the possibility of septic effluent overload in the subdivision. Samples were collected in November 2001 and May 2002.

Ground water samples were collected from ten domestic wells. Eight wells were located within the subdivision and two wells were located outside of the subdivision. One of the wells outside of the subdivision is up-gradient of the ground water flow and the other is cross-gradient. The wells located outside of the subdivision are on much larger acreage of property than the wells in the subdivision, which are only on about one half an acre per parcel. The homes in the subdivision have their own septic systems, with one well for two households.

Significant ground water quality impacts have been detected in the subdivision. The ground water impacts include elevated nitrate, specific conductance, chloride, and sulfate. The isotope results suggest a manure, septic system effluent or a mixed nitrate source. This area has marginal soil filtering capabilities with the thin lenses of sand and clay on top of basalt. It is important for the well owners in the area of Western Country Estates to be aware of their water quality in their domestic wells due to the ground water quality impacts.

## **Background**

The Southwest District Health Department (SWDHD), Nampa Office, conducted a mortgage survey at well #1 in July 2001 (see Figure 1). Two separate water samples collected from that domestic well in July 2001 yielded nitrate results of 16.8 and 18.2 mg/l. Three additional samples were collected from nearby wells on July 25, 2001. The first well, not included in this study and located about 700 feet to the west of the original well, had a nitrate level of 15.4 mg/l. The second well, located about 700 feet to the south of the original well (well #8) had a nitrate level of 5.9 mg/l. The third well, not included in this study and located about 800 feet to the southwest of the original well, had a nitrate level of 7.72 mg/l. Well #8 had previously been sampled by SWDHD on October 21, 1998 with a nitrate level of 5.59 mg/l.

A recent SWDHD inspection in September 2001 of a daycare facility in the subdivision had a nitrate level of 12.3 mg/l. This well which was not included in this study is located about 200 feet southeast of the well #1. The daycare facility provider is supplying an alternate source of drinking water.

The 42 lots in the Western Country Estates are on individual septic systems and share a well (two homes per well). The lot sizes are approximately one half acre in size, the entire subdivision is on approximately 25 acres. The water table, according to well driller's reports, is about 20 feet below land surface. The geology, according to well driller's reports, is sandy clay and sand to about 40 feet, underlain by basalt. The average well depth is about 100 feet and most wells are constructed with approximately 40 feet of casing with a bentonite surface seal from 18 feet to 40 feet down from the surface.

## **Project Purpose**

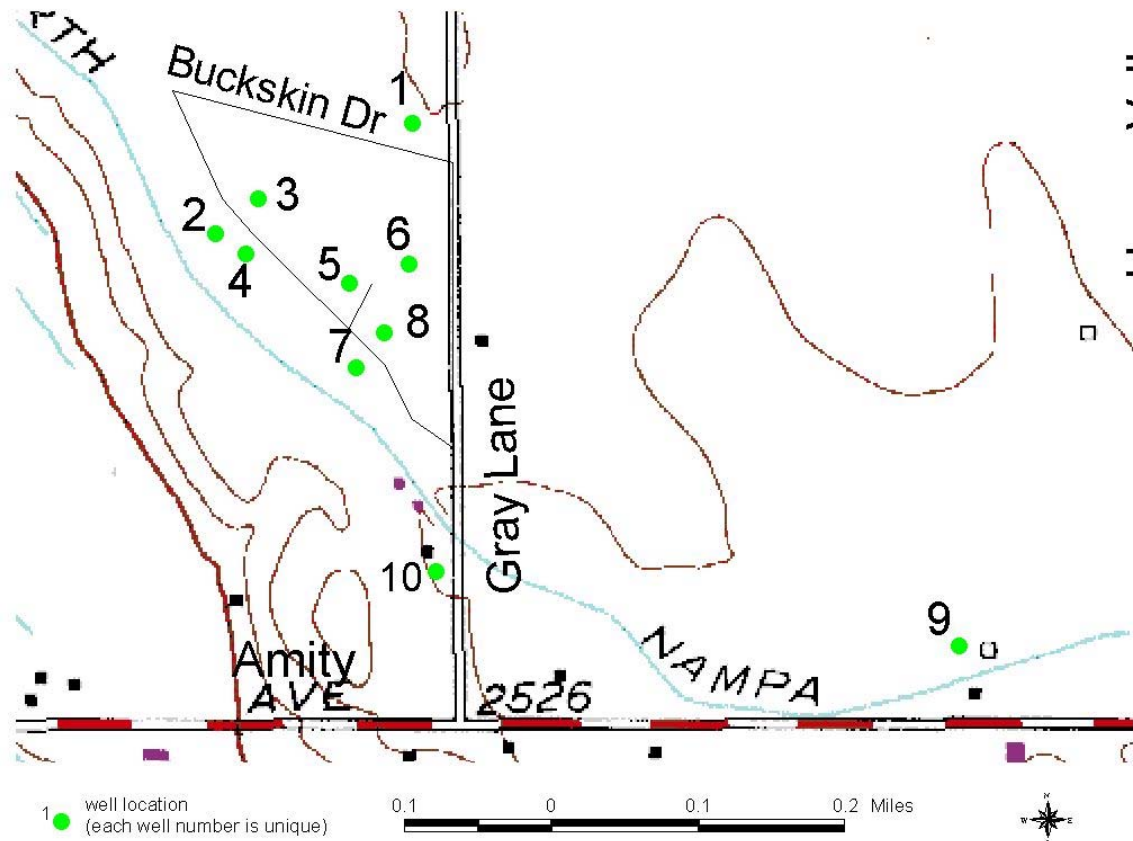
This ground water study will compliment the work that IDEQ has completed regarding subsurface disposal systems and Nutrient Pathogen Evaluations. It is believed that all of the septic systems installed at Western Country Estates were installed properly according to required setbacks for domestic wells and septic systems. Nutrient Pathogen Evaluations were not required at the time this subdivision was being developed to assess any potential ground water impacts from septic systems in the subdivision. This study is a regional ground water study, as recommended in the Ground Water Quality Plan (Ground Water 1996) and

directly relates to ground water quality protection of beneficial uses as listed in the Ground Water Quality Rule (IDAPA 1997).

Data collected during this study can be useful to Health Districts in Idaho to understand the problems associated when too many septic systems are allowed on small lots with marginal soil filtering capabilities. The aspect of this question has been a debated with no data to substantiate the consequences. SWDHD has required Nutrient Pathogen Evaluations since May 2002. This subdivision was developed in the early 1990's. A Nutrient Pathogen Evaluation would have shown this subdivision to be a potential problem with the individual septic systems, given the lot sizes at the developed density.

## Site Location

The study area is located on the eastern side of the City of Nampa, within Nampa's area of impact. It is located on the west side of Gray Lane about ¼ mile north of Amity Avenue in township 3 north, range 2 west and section 25. A map of the location of the subdivision can be found below.



**Figure 1. Site Location**

## Methods

Ten domestic wells were chosen for this study based upon well location, depth, construction, and access. Nine of these wells were sampled in November 2001. The owner of the tenth well requested to be a part of the study after the November 2001 sampling, consequently it was only sampled once in May 2002.

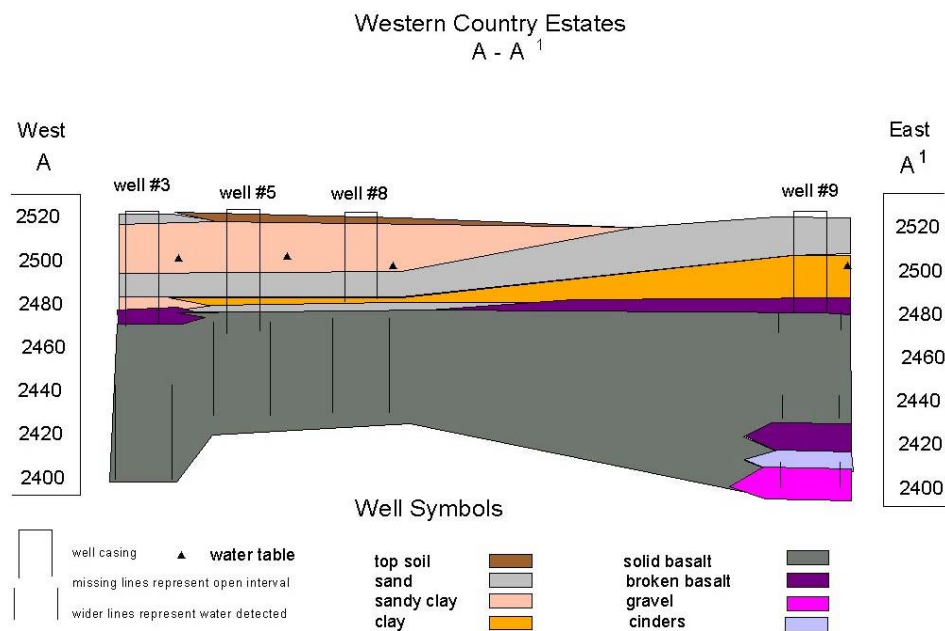
Ground water samples were collected from the ten wells and analyzed at the Idaho Department of Health & Welfare Bureau of Laboratories for total coliform bacteria, *Escherichia coli* bacteria, nitrate, ammonia, chloride, sulfate, and ortho-phosphate. The constituents analyzed by the Idaho Department of Health & Welfare Bureau of Laboratories were chosen for this study for their common presence in a septic system.

Isotope samples were collected for <sup>18</sup>Oxygen and <sup>15</sup>Nitrogen, and analyzed at the University of Waterloo in Canada. The isotope analyses are used to assist with the identification of the source of the nitrogen in the nitrate compound.

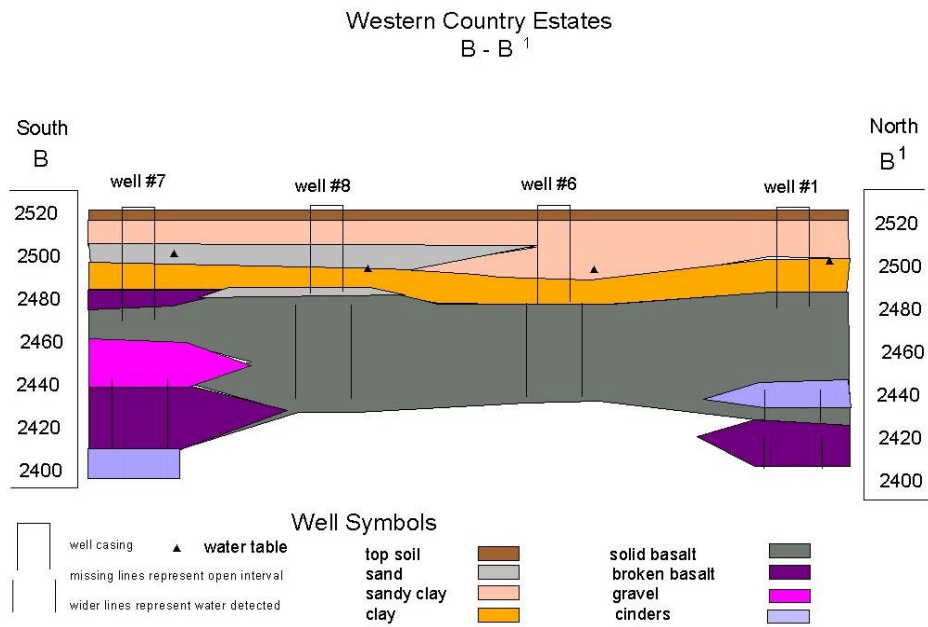
Field parameters were also collected at each well for water temperature, pH, specific conductance, and dissolved oxygen. Duplicate ground water samples were collected for quality assurance/quality control during each sampling event. Appendix A describes the field methods, data management, and quality control objectives.

## Geology

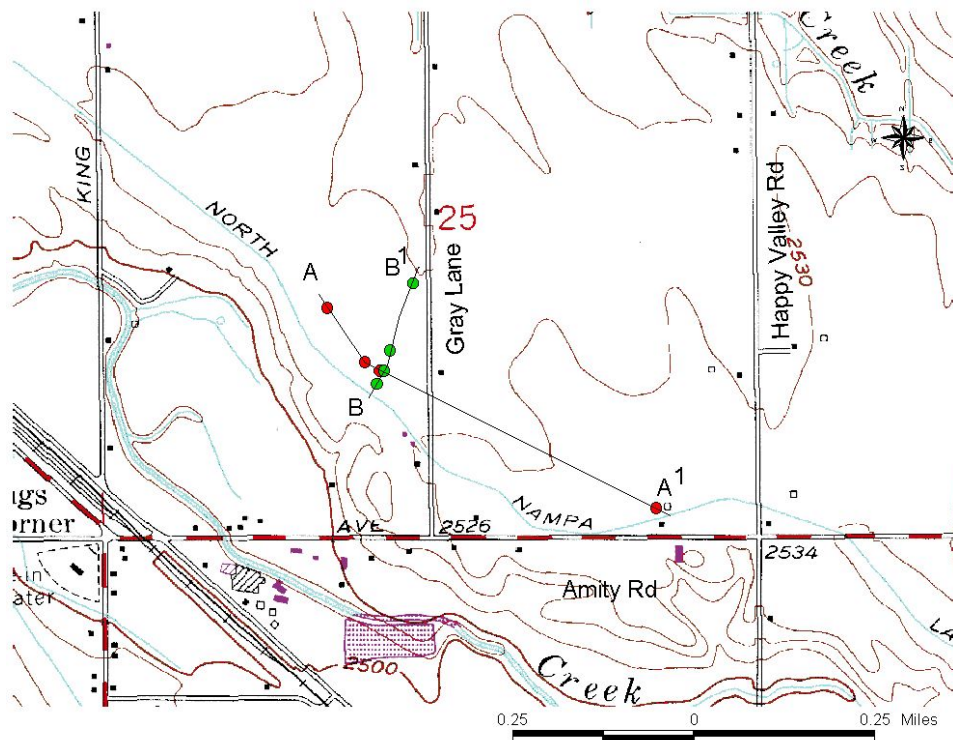
Kurt Othberg's 1994 study regarding the geology for this area shows this area to be basalt flows of Indian Creek buried by loess and stream sediments. Tan massive silt, light brown stratified clay, silt, sand and basalt are commonly found. Location of basalt is based on water well logs and geologic mapping. Figures 2 and 3 show the cross-section information of some of the wells based upon well driller's reports.



**Figure 2. Cross Section A**



**Figure 3. Cross Section B**



**Figure 4. Cross Section Location Map**

## Hydrology

The 1981 work of William Graham and Linford Campbell states that the ground water system is primarily within unconsolidated deposits of silt, sand, clay and fine gravel. Total thickness of the sediments is estimated to be 2500 feet in the Boise-Nampa area (Dion 1972). In places, Snake River Basalts are intercalated with the sedimentary deposits. The flow system is recharged primarily by leakage from the Boise River, drainage from the mountains to the north of the valley, and infiltration of diverted irrigation water. Yields to wells are reported to be sufficient for municipal and agricultural use throughout most of the valley.

Water quality within the Boise River valley ground water system varies by the strata within the sedimentary layers. The zones of the aquifer are interrelated, with clay layers functioning as limited divisions to the water bearing zones (IDWR 1995). The SWDHD has estimated the ground water gradient within the subdivision to be to the northeast from well and septic installation (verbal correspondence from Jami Delmore, SWDHD). There appears to be a ground water divide along the North Nampa Lateral, which correlates with the ground water gradient determined by the SWDHD (verbal correspondence from Joe Baldwin, IDEQ).

## Well Construction

The wells in this study range from 96 to 118 feet deep. These shallow wells encountered similar lithology. Approximately the first 45 feet of the wells is composed of sand, clay, and sandy clay layers. Below the sand and clay layers is basalt, which starts with broken basalt and continues to solid basalt according to the well driller reports.

The casing length for the wells range from 38.5 to 56 feet deep. All of the well casings stop at the basalt formation. Four of the wells have a surface seal down to at least 40 feet, deeper than the remainder of the wells. See the table below for the well driller's information on the wells in this study.

**Table 1. Well Driller's Information**

Well #	Drilled Depth (ft)	Casing Depth (ft)	Surface seal Type and depth (ft)	Lithologic Log (ft)
1	96	46	Bentonite, 40	0-5 soil, 5-35 sandy clay, 35-40 brn clay, 40-42 coarse sand, 42-46 broken lava, 46-76 solid lava, 76-79 red cinder, 79-89 solid lava, 89-96 broken lava
2	110	44	Bentonite, 44	0-4 soil, 4-28 sandy clay, 28-42 brn clay, 42-44 broken lava, 44-75 solid lava, 75-107 broken lava, 101-110 red cinder, 110- gravel
3	112	47	Bentonite, 25	0-6 sandy soil, 6-8 hard pan, 8-25 sandy clay, 25-30 coarse sand, 30-45 sandy clay, 45-47 broken lava, 47-110 solid lava, 110-112 brn clay, 112- gravel
4	104	56	Bentonite, 20	0-2 top soil, 2-4 hard pan, 4-26 sandy clay, 26-35 sand, 35-40 clay, 40-55 sand, 55-104 lava
5	104	56	Bentonite, 20	0-2 top soil, 2-4 hard pan, 4-26 sandy clay, 26-35 sand, 35-40 clay, 40-55 sand, 55-104 lava
6	104	52	Bentonite, 18	0-4 top soil, 4-18 hard pan, 18-30 sandy clay, 30-50 brn clay, 50-104 lava cracked
7	116	44	Bentonite, 44	0-3 soil, 3-25 sandy clay, 25-28 coarse sand, 28-40 brn clay, 40-44 broken lava, 44-65 solid lava, 65-69 red cinder, 69-116 broken lava, 116- gravel
8	104	45	Bentonite, 40	0-2 top soil, 2-4 hard pan, 4-26 sandy clay, 26-35 sand, 35-40 clay, 40-55 sand, 55-104 lava
9	118	38.5	Puddling clay, 20	0-12 sandy soil, 12-24 sand, 24-32 soft clay, 32-36 loose lava and clay, 36-75 solid lava, 75-80 lava crevices, 80-112 solid lava, 112-116 cinders and clay, 116-118 sand and gravel
10	unknown	unknown	unknown	unknown

## Results

### Field Parameters

Meters were used while running the water prior to collecting samples to measure water temperature, pH, specific conductance, and dissolved oxygen. These measurements determined sample collection time (see Methods) and they provided a basic correlation to determine if the ground water is being pumped from similar water-bearing systems. The water temperature, pH and dissolved oxygen were similar at each well, which is an indication that all the wells are likely pumping water from the same water-bearing system.

The specific conductance measured higher in the wells that had the highest nitrate analyses. Well #10 had the lowest nitrate concentration at 4.5 mg/L and one of the lowest specific conductance measurements at 501 US/cm. Conversely, well #1 with the highest nitrate concentration at 14.8 mg/L had one of the highest specific conductance measurements of 858 US/cm. Table 2 summarizes the field parameters and analytical results for this study.

**Table 2. Ground water Results for each Well**

well #	date sampled	temp	pH	sp cond	total coli	DO	NO3	NH3	chloride	SO4	O-PO4	18 O	15 N
1-kitchen	05/28/02	14.1	6.99	851	0	9.54	2.16						
1	05/28/02	14.1	6.99	851		9.54						-2.75	
1	05/28/02	14.1	6.99	851	0	9.54	13.7	0	13.3	40.7	0.069	-2.78	5.46
1	11/19/01	13.6	7.06	858	0	8.16	14.8	0	13.3	39.8	0.062	-3.11	4.87
1	11/19/01	13.6	7.06	858	0	8.16	14.8	0	13.3	39.8	0.061	-3.11	4.87
10	05/29/02	15.4	7.52	501	2	7.19	4.55	0	7.57	31.7	0.087	-0.8	8.57
10	05/29/02	15.4	7.52	501		7.19	4.46	0.01	7.15	31.6	0.086	-1.23	
2	05/28/02	14.7	7.47	787	1	8.84	6.76	0	14	66.7	0.038	-1.53	6.69
2	11/19/01	14.3	7.43	881	11	13.53	7.16	0	24.5	86.4	0.045	-1.21	6.19
3	05/28/02	14.7	7.39	801	7	9.3	8.23	0	11.8	57.8	0.036	-2.13	6.62
3	05/28/02	14.7	7.39	801		9.3							6.46
3	11/19/01	14.2	7.34	882	0	14.97	9.71	0	16.6	64.1	0.033	-3.01	5.75
3	11/19/01	14.2	7.34	882	0	14.97	9.71	0	16.6	64.1	0.033	-3.01	5.82
4	05/28/02	14.3	7.56	717	0	10.94	6.37	0.007	10.8	42	0.048	-2.43	6.44
4	11/19/01	14	7.33	756	0	11.63	7.38	0	13.6	43	0.042	-2.58	6.57
5	05/28/02	14.3	7.36	781	0	8.75	8.87	0	11.7	38.9	0.049	-2.9	6.75
5	11/19/01	13.9	7.06	922	0	8.57	12.9	0	20.6	59.7	0.043	-3.36	6.42
6	05/28/02	13.8	7.54	862	0	11.05	10.5	0	15.9	53.6	0.037	-2.65	5.69
6	11/19/01	13.6	7.29	873	0	8.54	10.8	0	15.6	57	0.037	-2.06	7.87
7	05/28/02	14.5	7.55	715	0	11.93	6.38	0	11.4	40.4	0.056	-0.63	6.65
7	11/19/01	14.1	7.34	680	0	8.83	5.92	0.007	12.7	37.7	0.053	-3.26	7.28
8	05/28/02	14.3	7.53	645	0	9.63	5.22	0	12.4	35.4	0.062	-1.82	7.28

well #	date sampled	temp	pH	sp cond	total coli	DO	NO3	NH3	chloride	SO4	O-PO4	18 O	15 N
8	11/29/01	13.8	7.24	695	0	7	6.11	0.008	14.5	40.7	0.053	-1.92	
8	11/29/01	13.8	7.24	695	0	7	6.11	0.008	14.5	40.7	0.053	-1.53	7.06
9	05/29/02	14.8	7.38	517	0	7.46	6.21	0	7.07	33.6	0.067	-2.73	7.59
9	11/19/01	14.5	7.34	500	0	9.05	5.24	0.005	6.92	16.4	0.089	-1.52	10.52

Notes:

temp = temperature (°Celsius)

pH (standard units)

sp cond = specific conductance (US/cm)

total coli = total coliform bacteria (colonies/ 100 ml)

DO = dissolved oxygen (mg/L)

NO3 = nitrate (mg/L)

NH3 = ammonia (mg/L)

chloride = chloride (mg/L)

SO4 = sulfate (mg/L)

O-PO4 = ortho-phosphate (mg/L)

18 O = <sup>18</sup>Oxygen isotope

15 N = <sup>15</sup>Nitrogen isotope

## Bacteria

The main benefit of testing for the presence of total coliform bacteria is to assure the sanitary condition of a well. The total coliform analysis indicates the growth of opportunistic bacteria that are able to utilize lactose or a similar product. The presence of these opportunistic bacteria suggests that the ground water quality is able to support pathogenic bacteria. It is uncommon to find widespread ground water contaminated with bacteria. Bacteria contamination is normally indicative of a localized water system problem.

Pathogenic bacteria are a type of bacteria that can cause health problems. Escherichia coliform bacteria analysis is used to determine if the pathogenic bacteria are present. The Escherichia coliform bacteria are necessary and common in mammalian intestines, however these bacteria can cause health problems when ingested by humans.

Bacteria can be introduced into a well from a poor surface seal, breaks in the piping, repairs to the system, and/or installing parts to the system. Disinfecting a well normally removes the bacteria problem. Sometimes it can take numerous disinfecting series to completely remove the bacteria, since bacteria grows in concentric rings and each process of disinfecting removes the outer most ring of bacteria allowing the next inner ring to flourish.

Three of the wells in this study had positive total coliform bacteria results. None of the wells had positive Escherichia coliform bacteria results. Technical assistance and the offer to re-sample after the well owner disinfected their well was provided.

## Nitrate

Nitrate impacts were detected throughout the study area. Wells located outside of the subdivision have the lowest nitrate results. However, even those wells have nitrate results that are higher than the 2 mg/L for nitrate that is considered ambient level. Nitrate above the ambient level of 2 mg/L can be considered impacted from land use activities such as applied fertilizers, septic effluent, livestock, crop residue, and wastewater lagoons.

The November 2001 nitrate results ranged from 5.24 – 14.8 mg/L. Well #9, which is located outside of the subdivision, had the lowest nitrate result of 5.24 mg/L result. Well #1 had the highest nitrate result of 14.8 mg/L results. Well #1 also had the previous high nitrate levels determined by SWDHD in July 2001, which

in turn generated the interest in this ground water study. Well #10 was not sampled in November 2001 due to lack of permission. Well #6 also exceeded the maximum contaminant level (MCL) of 10 mg/L for nitrate.

The May 2002 nitrate results ranged for 4.5 – 13.7 mg/L. Similar to the November 2001 results, the wells located outside of the subdivision had the lowest nitrate result. Well #9 and 10 had nitrate results of 6.21 mg/L and 4.5 mg/L, respectfully. Both of these wells are located outside of the subdivision. Well #1, again, had the highest nitrate level of 13.7 mg/L. Well #6, again, exceeded the MCL for nitrate in May.

A sample was collected from inside the house at well #1 in May 2002 to determine the nitrate level after the water had gone through the home treatment system. That nitrate result was 2.16 mg/L, which shows a significant improvement in the nitrate level.

The nitrate levels are showing an increase in concentration that follows the known ground water gradient to the northeast. Well construction may be contributing to the nitrate impacts. Wells in the subdivision with surface seals placed the length of the casing have a lower nitrate level than wells that have a surface seal less than the length of the well casing (see Table 1).

## **Ammonia**

The ammonia results were not at a level of concern. Every well had at least one ammonia result that was non-detect or less than 0.005 mg/L. There were five wells, which had a detectable ammonia level. The greatest concentration of ammonia was 0.01 mg/L, which is a very low concentration.

The ammonia may be utilized by plants and soil bacteria or the ammonia could be converted to the nitrate that has been found in the ground water samples. The ammonia is commonly found in the anaerobic environments of the septic holding tank and biological mat under the field drain. As the effluent leaves the field drain the ammonia is converted to nitrate in the aerobic environment.

## **Chloride**

The range of chloride results was 7.07 – 24.5 mg/L. The wells located outside of the subdivision had the lowest chloride results. Chloride moves readily with the ground water gradient. The chloride is introduced to the ground water by human activity.

## **Sulfate**

The range of sulfate results was 16.4 – 86.4 mg/L. The lowest sulfate concentrations were found in the wells outside of the subdivision. There was no apparent increase in sulfate concentration at the most down-gradient well in the subdivision, as was found with the nitrate levels.

Sulfate goes through a similar process in a septic system as ammonia does. Hydrogen sulfide is found in the septic holding tank and biological mat and is converted to sulfate upon leaving the field drain.

## **Ortho-Phosphate**

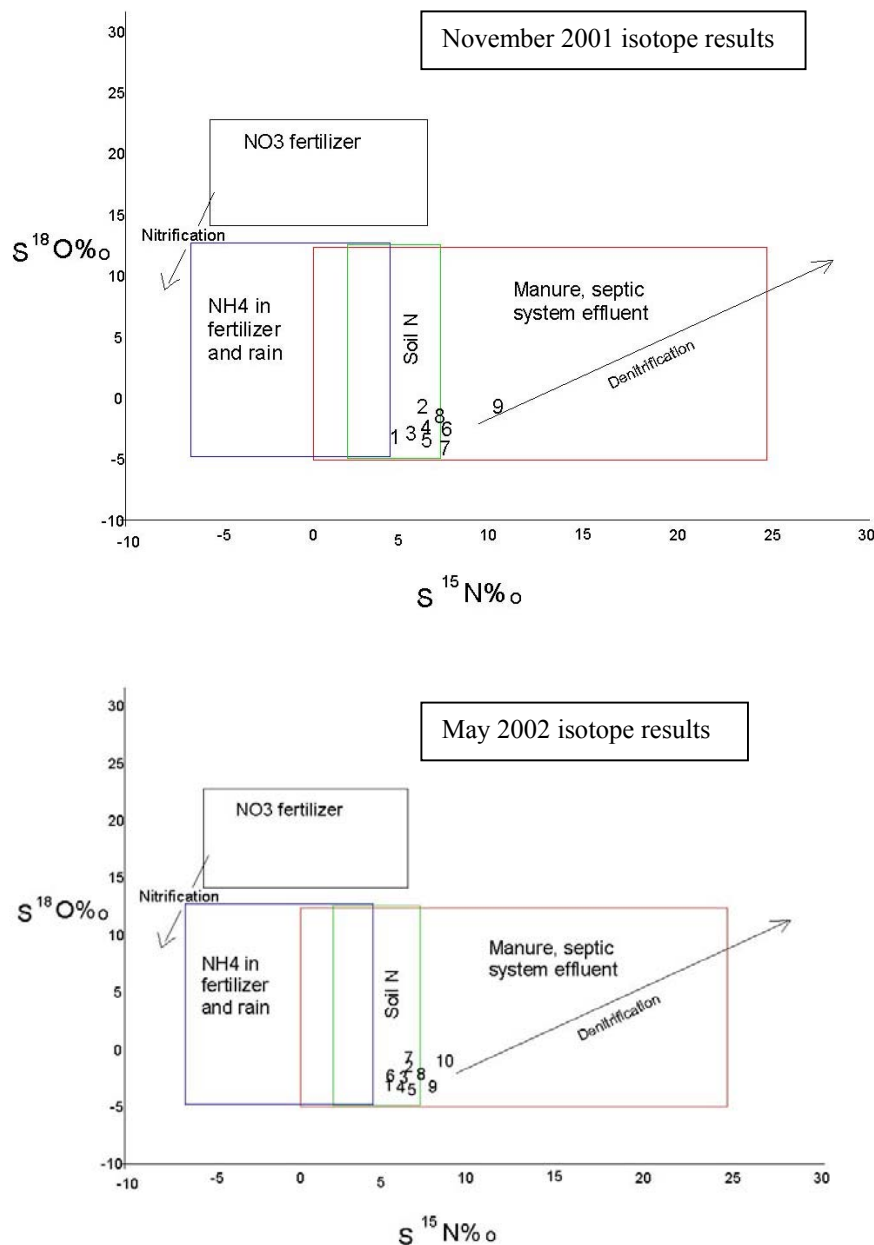
The range of ortho-phosphate results was 0.033 – 0.089 mg/L. The highest ortho-phosphate concentration was found in the wells outside of the subdivision. The ortho-phosphorus is relatively consistent with data collected throughout southwest Idaho. The ortho-phosphate concentration found in ground water is significant, because of the possible contribution to surface water concentrations.

## Isotopes

The ratio (denoted  $\delta^{15}\text{N}$ ) of the common nitrogen isotope  $^{14}\text{N}$  to its less abundant counterpart  $^{15}\text{N}$  can be useful in determining sources of nitrate. Common sources of nitrate in ground water are: applied commercial fertilizers, animal or human waste, precipitation, and organic nitrogen in the soil. Each of these nitrate source categories has a distinguishable nitrogen isotope signature.

Use of nitrogen isotopes as the sole means to determine nitrate source should be done with great care.  $\delta^{15}\text{N}$  values of fertilizer and animal waste in ground water can be complicated by several reactions (e.g. ammonia volatilization, nitrification, de-nitrification, ion exchange, and plant uptake) that can significantly modify the  $\delta^{15}\text{N}$  values (Kendall and McDonnell 1998). Furthermore, mixing of sources along shallow flow-paths makes determination of sources and extent of de-nitrification very difficult (Kendall and McDonnell 1998). The Laboratory methods used to determine an isotope is not an approved method with the U.S. Environmental Protection Agency at this time.

Kendall and McDonnell (1998) have developed the following chart in Figure 6 which compares the  $\delta^{18}\text{O}$  isotope from the nitrate compound values to the  $\delta^{15}\text{N}$  values.  $\delta^{18}\text{O}$  is the ratio of the common isotope  $^{16}\text{O}$  to its less abundant counterpart  $^{18}\text{O}$ . Figure 6 shows the possible nitrate sources from the November 2001 and the May 2002 isotope results. The numbers within the charts correspond to the previously identified well numbers.



**Figure 5. Isotope Results Graphs**

The above isotope results show a greater source of nitrogen from manure and septic system effluent for the wells #6, 7, 8, and 9 in November 2001 and wells #8, 9 and 10 in May 2002. The remaining wells are showing a mixture of nitrogen sources from natural nitrogen in soil, manure, and septic system effluent.

## Discussion

Western Country Estates subdivision is located in Canyon County and within area of impact for the City of Nampa at the time of this study. Adjoining subdivisions to the west are within Nampa's city limits with city water and sewer provided to those homeowners. The subdivisions to the north are all unique because

some of them have city water and sewer provided and others have city water and individual septic systems. The subdivision to the east is currently being built.

Conversations with the well owners during the ground water sampling for this project were about their water concerns, which were many. They were concerned that their ground water may not be safe to drink, as the results show some of the wells exceed the nitrate MCL. They were concerned that the City of Nampa was going to annex them and force them to hook-up to city water and sewer. They were concerned that they would not be able to afford the city's hook-up costs. They, also, were concerned that their property values could diminish due to the ground water impacts.

The purpose of this study was to determine if there are ground water impacts in the subdivision and how to get this information to the well owners so that they can then make informed decisions about their water quality needs. Those with impacted ground water quality should evaluate installing a home water treatment system for their families health needs or look at alternative sources. Two possible alternative water sources are purchasing bottled water for their consumptive needs or hooking up to city water if available.

The data indicates that there are significant ground water impacts in the subdivision. This subdivision was developed in the early 1990's. Nitrate was first detected during a mortgage survey and the follow-up sampling of four wells in the subdivision conducted by Southwest District Health Department in July 2001. Two of the four wells sampled by Southwest District Health Department exceeded 10 mg/L for nitrate.

This study confirms the nitrate contamination found by Southwest District Health Department. The up-gradient wells in the subdivision have similar nitrate levels as the up-gradient wells located outside of the subdivision. The down-gradient wells show the highest nitrate levels. The chloride and sulfate levels are higher in the subdivision than in the up-gradient wells located outside of the subdivision. These constituents are normally found in a septic system.

The isotope results showed a mixing of nitrogen sources. The isotope results show a greater source of nitrogen from manure and septic system effluent for the wells #6, 7, 8, and 9 in November 2001 and wells #8, 9 and 10 in May 2003. The remaining wells indicate mixture of nitrogen sources from natural nitrogen in soil, manure, and septic system effluent.

The ground water impacts from elevated nitrate are a concern for the well owners in the area. Elevated nitrate levels were found in wells in the subdivision. Wells located outside of the subdivision were not at the elevated concentration of nitrate as was found in some wells in the subdivision. Well owners need to be knowledgeable of their nitrate levels in their ground water so that they can make informed decisions regarding their water needs.

Domestic well owners are responsible for maintaining their wells and determining their water quality. Unlike a public water system (which sells water) domestic well owners do not have governmental over-site to guarantee that the water is of good quality. An IDEQ information document "Well Owners" explains how well owners need to periodically sample their ground water and maintain their wellheads. Also, if ground water problems are found how to choose a home treatment system that will take care of their needs. That document can be found on the IDEQ webpage at [http://www.deq.state.id.us/water/wells/well\\_owners\\_news\\_jan01.pdf](http://www.deq.state.id.us/water/wells/well_owners_news_jan01.pdf).

Owners of individual septic systems need to understand how to take care of their septic systems. Proper maintenance of a septic system will help protect ground water quality and minimize the possibility of a septic system failure. More information can be found in the IDEQ information document called "A Homeowners Guide to Septic Systems" or at the IDEQ webpage at [http://www.deq.state.id.us/water/gw/septicsystems\\_homeownersguide.pdf](http://www.deq.state.id.us/water/gw/septicsystems_homeownersguide.pdf).

The University of Idaho has several brochures to assist residential homeowners in the use of fertilizers and chemicals correctly without impacting the ground water. A list of these brochures can be found at <http://www.uidaho.edu/wq/wqbr/wqbrlist.html>.

## Recommendations

- Provide the data gathered from this study to all the homeowners in the Western Country Estates.
- The wells known to have impacted ground water quality should evaluate installing a home water treatment system for their families health needs or look at alternative sources.
- Educate well owners regarding their responsibility for their water quality and the maintenance of their wells.
- Educate septic system owners regarding their responsibility for the maintenance of their septic system.
- Educate homeowners regarding their responsibility proper use of fertilizers and chemicals.

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## Appendix A

### Ground Water Sampling Procedures

1. For domestic wells, select a sampling location in the water system as close to the well as possible and before any treatment equipment. Note any unique or otherwise pertinent characteristics of the well, water distribution system, or the property in a field notebook.
2. Turn the sample tap on and allow water in the well casing and piping to purge prior to sample collection. Adequate purging will be based on stabilization of pH, temperature, and specific conductance measurements (field parameters) taken at the sampling location. Field parameter measurements will be considered stable when three successive measurements taken at intervals of five minutes or more differ by less than the following amounts:

specific conductance.....5%  
PH.....0.1 unit  
temperature.....0.2 degrees Celsius

During the purging procedure, divert part of the flow (using a double-hose connector) into a bucket for flow-through measurement of field parameters. Variations in purge time may need to be made depending on the characteristics of the water system (e.g., extra large storage tank, ect.). After purging, disconnect all hoses and allow water to run an additional 10 to 15 seconds prior to sample collection. Sampling from indoor plumbing fixtures will require a modification of this procedure.

3. Collect all samples in properly prepared containers provided or approved by the analytical laboratory. Carefully follow DEQ standard sample labeling, documentation, chain-of-custody, and transportation procedures. Personnel shall wear latex gloves while sampling. Field data sheets (attached) will be completed for each sample location.

### Sample Custody

Sample custody procedures should conform to standard DEQ and ISDA protocols.

### Calibration Procedures and Preventative Maintenance

Maintenance and calibration of field measuring devices will be performed at each sampling location following manufacture's specifications. Field water quality parameters will be measured with appropriate water quality meters and probes.

### Quality Control Checks

Field QC samples will consist of one duplicate ground water sample collected at random for each day of sampling by the field team and submitted as a blind sample to the laboratory for analyses. Transfer blanks will be collected each sampling quarter to assure field handling techniques. Internal laboratory QC checks should consist of Idaho Bureau of Laboratories standard operating protocols.

### Data Management

A sampling technical support team is responsible for collection, storage, and transport of field data to the office. A standard system for sample labeling and correlation with appropriate field notes and QC checks will be developed by the team.

Laboratory and field data will be compiled by the Data Management Representative and routed to appropriate DEQ and ISDA staff for technical or enforcement needs. Laboratory data will be submitted for entry into the Environmental Data Management System (EDMS), if practical.

### Data Reduction and Validation

Laboratory data reduction will be performed by the Idaho Bureau of Laboratories. Data will be checked by the laboratory for precision and accuracy. If data lie outside acceptable limits, the appropriate parameters must either be reanalyzed or considered for corrective action. The Analytical Services Representative is responsible for the final laboratory report to be submitted to the Data Management Representative.

### Quality Assurance Objectives for Measurement Data

<u>Parameter</u>	<u>Matrix</u>	<u>EPA Method</u>	<u>Detection Limit (mg/L)</u>	<u>Accuracy</u>	<u>Precision</u>	<u>Completeness</u>
Total Coliform	water	Colilert	positive/negative	1/100 ml	NA	NA
Escherichia Coliform	water	Colilert	positive/negative	1/100 ml	NA	NA
Ammonia	water	300.0	0.005	80-120%	+/-15%	95%
Total NO <sub>2</sub> + NO <sub>3</sub> as N	water	353.2	0.005	80-120%	+/-15%	95%
Sulfate	water	300.0	2	80-120%	+/-15%	95%
Chloride	water	300.0	2	80-120%	+/-15%	95%
Ortho-Phosphate	water	300.0	0.005	80-120%	+/-15%	95%
Isotope Sampling	water	NA	NA	NA	NA	NA

Notes:

mg/L = milligram per liter

NA = not applicable